

Corson (J. W.)

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PAPER ON THE
EFFECTS OF LEAD ON THE HEART.

BY

JOHN W. CORSON, M.D.,

LATE PHYSICIAN TO BROOKLYN CITY HOSPITAL; PHYSICIAN TO THE
NEW YORK DISPENSARY.

Re-printed from New York Journal of Medicine, for March, 1856.

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EFFECTS OF LEAD ON THE HEART.

NOTHING is unimportant in the science of saving life. If we note faithfully the slightest change in the face, skin, eye, tongue, breathing, voice, secretions, or distant radial pulse—surely we should examine carefully the heart itself. It has strong claims. We have long been convinced, that not merely in cardiac affections, but in disease generally, too little regard has been paid to the varying force and volume with which it strikes against the ribs, or, in other words, to the *impulse* of the heart. There is something still to learn. The Chinese physicians are said to pass the hand over the heart as often as they feel for the pulse at the wrist. Nor do these always correspond. As Wardrop has shown, and as we may often observe, the heart may violently labor when the pulse at the wrist is feeble.

While, indirectly, it might explain some curious effects of lead upon the heart's action, which we shall presently mention, we cannot here stop to discuss the knotty physiological question of the exact cause of the cardiac impulse. Skoda has with learned detail, given more than half a dozen ingenious theories on this subject by Corrigan, Stokes, Bouillaud, Filhos, Gutbrod, Messerschmid, Gendrin, Von Kiwisch, and others.* In passing, we may simply remark, that the Committee of the British Association, and others, having at last pretty well decided as to the causes of the two sounds of the heart, we trust some new light may yet be thrown upon the vexed question as to the true origin of the heart's impulse, by the proposed inquiry under the auspices of the American Medical Association.

Theorize as we may, we must admit that its variations are important signs of disease. *With enlarged dull space*, as we know, a broad heaving impulse of the heart means organic hypertrophy, and weak, wide, flapping dilatation; while, *without extra dullness*, strong bounding denotes mere congestion of the organ; smart rapping, functional irritation; and soft tapping, cardiac debility. And these lessons from the heart not only aid us in diagnosis, but in treatment. When we remember that in apparent death from catalepsy, electricity, or drowning, its faintest beat is the last sign of life, and calls for the most powerful restoratives; and that, as Dr. Stokes has shown, the weakness or absence of its impulse or first sound, is the true test for wine

* *Abhandlung über Perkussion und Auskultation.*

in typhus fever; and add to these, the facts we shall presently state to prove that a faint cardiac impulse with purple gums, promptly suggests lead poisoning, and the use of the iodide of potassium and strychnia; we shall come to regard the action of the heart as no mean guide in the administration of many remedies. As we have recently had occasion to remark in these pages, allowing a certain excess to compensate for the embarrassed circulation in organic enlargement, *the impulse is the true pulse of the heart*, showing by its force or weakness, when either depletion, sedatives, or tonics are necessary.*

To disprove or confirm these views respecting the importance of the cardiac impulse, the writer was induced, some time since, to undertake a series of examinations of the heart promiscuously in all forms of disease among the throng of patients at a large Dispensary. Many interesting facts presented. We soon found that house painters and others with either *paralysis* or great *muscular debility*, from lead poisoning, had uniformly a more or less weakened impulse of the heart, and generally on going up stairs complained of some faintness and cardiac distress. In some instances, too, there were fear of sudden death, nocturnal syncope, night-mare, or oppressive dreams, like those so common in organic disease of the heart. In the earlier stage, where lead colic only existed, from a considerable number of observations it seemed as if the heart had as yet escaped, and these symptoms were absent. And whether they are present uniformly in all cases of lead paralysis and debility, must be determined by more extended observation. Yet if they should be found to be confined mainly to the worst cases in private practice, or to the long neglected and badly nourished poor, prostrated by lead, and seeking medical aid in public institutions as a last resort—still, we trust, this discussion may be useful in showing a new phase of the affection worthy of careful attention. It is the sacred mission of our profession to study and toil for the poorest. In private practice, too, as will be seen, it may sometimes enable us to relieve terrible suspicions of incurable disease of the heart.

The discovery of the leaden streak of the gums by Dr. Burton, was a real boon to humanity. We cannot have too many new tests for so insidious and distressing a malady. When the heart, too, can complain, we should listen to its language. If a few years have given us the vastly improved treatment of Melsens, Golding Bird, and Tanquerel, so, too, every year finds new employment for this ductile poisonous metal. Lead is all around us in a hundred protean forms. We find

* On Protracted Valvular Disease, May, 1855.

it hidden in arts and manufactures innumerable. It moulds the toys of our childhood and wraps us in our coffins. It reddens sugar plums and sealed parchments, paints in varied hues the cottage and palace, blackens alike the fingers of the civilized printer and savage hunter, and whitens the Brussels lace on the snowy neck of the city belle.* Sometimes it steals into sugar and tobacco, and literally spoils even our bread and butter. Deceptively it sweetens the choice wines of the epicure, or bubbles from natural wells, and from beer and soda fountains; and, through a thousand leaden arteries piercing the walls of our houses, it brings the Croton and Schuylkill to the very lips of the lovers of cold water. We seek not to exaggerate, but only faithfully to caution. While thousands exposed wonderfully escape, too many of the susceptible or careless suffer. But we cannot linger even to warn. Our cases must speak for themselves. We have vowed—as we always do—not to exercise what a good man once called the “gift of continuance.” The two first, it will be perceived, had previous organic disease from rheumatism.

Case 1.—Mitral Regurgitation with Hypertrophy, from Rheumatism, aggravated by Lead Poisoning.—Great Improvement.—J. S., aged 34, formerly seaman, latterly wafer-maker, muscular, but tottering in his gait and cachectic in his appearance, was admitted under my care at the New York Dispensary, June 7, 1854. After several attacks of acute rheumatism at sea, without any heart symptoms, he had worked latterly in a wafer and sealing-wax manufactory at New Rochelle, where, after being weakened by an attack of intermittent, he had been finally laid up with colic, from the fumes of heated lead used in the coloring matters. Returning to sea for his health, he again caught rheumatism, followed by dropsy, and had left the Dreadnought Hospital Ship, in the Thames, with a certificate of “Organic Disease of the Heart,” requiring light labor. Obligated to return to the more quiet wafer making, to fill his cup of misery, he had suffered five successive attacks of lead colic, the last of which was two weeks previous to his admission at the Dispensary.

Condition.—There were noted—the dusky, tawny lead jaundice of the skin, and brown encrusted teeth mentioned by Tanquerel; *purple streak of the gums*; pulse ninety-two, weak and small; respiration thirty, difficult; despondency; sense of impending dissolution; fear of sudden death; *faintness on exertion*; palpitation; *broad weak impulse of the heart*; harsh liquid mitral, regurgitant murmur with the first

* *Annales d'Hygiène.*

sound, *loudest over the apex*; diameter of precordial dull space, three and a-half inches; apex pointing four and a-half inches to the left of the centre of the sternum; liver enlarged below two inches; epigastrium tender; appetite feeble and variable; constipation; slight incipient paralysis of the limbs, affecting motion more than sensation, though accompanied with some numbness and wandering pains, and without the "drop wrists."

He was ordered to take, in an aqueous mixture, eight grains of the iodide of potassium, with four grains of the extract of taraxacum, a fluid dram of the tincture of bark, and ten drops of the tincture of hyoscyamus, in sweetened water, three times a-day, two hours after meals. This was continued with the greatest benefit for three months, when it was changed to five drops of the strong tincture of nux vomica alone, taken in water, three times a-day, for three months longer. The effects were remarkable. His jaundiced face became clear and ruddy; the respirations fell off from 30 to 18; the numbness, faintness, and lead streak were gone; the faltering heart, though still enlarged, grew firmer in its impulse; the liver, with its hypertrophy remaining, ceased to trouble; appetite returned, and he gained ten pounds in weight. But the most curious changes were those of the mitral murmur. Sometimes it was distinct and liquid, like the sound of a muffled syringe; then it grew faint and musical, like the low mewing of an exhausted kitten; later still, it intermitted or returned with quiet or excitement, till, during the last few months it ceased entirely. Our patient, previously incapacitated, returned to regular labor in a ship bakery, and, a few months after, was so restored as to engage as seaman in a trip to New Orleans, during which he was accidentally drowned.

Case 2.—Slight Cardiac Hypertrophy and Mitral Murmur from Rheumatism.—Lead Poisoning.—Improved by Iodide of Potassium.—F. K. P., peddler, aged 36, muscular, but pale, was admitted as a district patient at the New York Dispensary, December 15th, 1855; with excruciating pain in the abdomen and lumbar region; face anxious; pulse 90, hard; tongue furred; gums with a broad violet streak; teeth brown-encrusted; obstinate constipation; nausea; urine scanty, and painfully voided; palpitation; cardiac oppression; strong impulse of the heart; dull space a little enlarged, and a faint regurgitant mitral murmur at the apex. There was no paralysis. Within the previous eleven years he had suffered three attacks of severe rheumatism, since the first of which he had labored at times under palpitation and some distress at the heart. For some time previous he drank spirits pretty freely. He had known of no exposure to lead, except,

possibly, from a habit of rising very early, and getting the first draught of Croton water from the long lead pipe of a high tenant-house ; and occasional drinks of soda-water from the street fountains. Our diagnosis was lead colic, added to slight organic disease of the heart. Two worthy, intelligent physicians, previously called, quite as sincerely pronounced the gums simply anemic ; laid much stress on the former rheumatic and cardiac disease, and thought the pain, nausea, and dysuria showed the present difficulty to depend simply on inflammation of the kidneys.

Being left alone in charge, with some misgivings that we might be mistaken, we were at length gratified with seeing prompt relief from free purging with croton oil and calomel, followed by anodynes ; and the generous admission of one of the former attendants, that we were right in our suspicions of lead. The patient was left much prostrated, and unable to walk out for many days. During the succeeding few weeks, he labored under great muscular weakness. Under the use of ten grains of the iodide of potassium, in solution, with five drops of the tincture of nux vomica, and a minute dose of hyoseyamus, three times a-day, he at last rapidly improved. By a curious coincidence, the mitral murmur was inaudible the two last examinations. It may also be remarked, that the irritation of pain in lead colic, as well as the previous hypertrophy, rendered the impulse more firm. When last seen, the case was still mending under treatment.

Although functional murmurs are notoriously changeable and transient, yet the permanent cessation of a true chronic organic murmur long established, with a corresponding improvement of the patient, is a very rare event. It is true that when the heart, so to speak, gives way, and becomes irregular and confused in its action, in the last stage of fatal cases, the murmur will often be masked or lost. And, in more favorable conditions, it will frequently cease with the repose of the patient, to be roused again with excitement. In a few examples, however, nature, in her freaks seems to have, to a certain extent, repaired and refitted even a spoiled valve, and silenced or changed its murmur.

Such cases are recorded by Dr. O'Ferrall, in the *Dublin Quarterly Journal of Medical Science*, and by M. Forget, in his recent valuable treatise.* The first of the above instances happening to be the only one that we had met at the time, was watched carefully for months, and was undoubtedly a fair specimen. The second, for a won-

* *Précis Théorique et Pratique des Maladies du Cœur.*

der, may possibly prove so. We may never meet another. We know, indeed, that, especially in delicate females, a heart may be stretched and weakened by simple dilatation till its valves are mechanically unfitted, and regurgitant murmurs occur. And it would be easy to speculate on the possibility of lead producing a certain relaxed, paralyzed or atonic condition of the muscular walls of the heart, or its columnæ carneæ, so that the valves temporarily unfitted, would leak, and afterwards, by the iodide of potassium and tonics, the heart might recover its natural tone, and the valves be readjusted. But in neither case above are we sure that the murmurs did not exist long before the lead affection. Besides, when dealing with health and life, we dare not speculate on such small capital. We love the truth, and the truth only, too dearly to venture to build a theory on so few facts. So we leave the reader to draw his own inferences in regard to the changes of valvular murmurs. In other respects, however, we think that, considering fairly the future cases where lead has deranged hearts previously sound, and where, upon one of the principles laid down by Marshall Hall, the result of treatment has aided diagnosis, analogy will justify two practical conclusions,—first, *that the poison of lead may seriously aggravate previous organic disease of the heart*; and second, *that such cases are likely to be especially benefitted by the iodide of potassium, strychnia, electricity, and other appropriate remedies for the depressing influence of lead.*

While studying the cardiac impulse, the writer happened to contribute, in a paper in this journal, the following illustration :—*

Case 3.—Debility of the Heart from Lead Poisoning.—Recovery.
—A laborer, aged 34, muscular, having worked in a white-lead manufactory a few weeks, was admitted under our care in the New York Dispensary, early in October last, for palpitation, uneasiness, and *faintness* on exertion, with precordial distress, and *soft tapping impulse of the heart*, otherwise normal, with the *violet lead streak* of the gums, trembling weakness and numbness of the limbs, pulse 74, *weak*; loss of appetite, nausea, tenderness of the epigastrium, and constipation. He never had rheumatism; used no tobacco; indulged in no excess. Partially on the plan of M. Melsens in lead disease, he was ordered ten grains of the iodide of potassium in solution, with a few drops of the tincture of nux vomica three times a-day; and subsequently these were aided by a blister, the size of a cent, over the heart, dressed with

* *On Functional and Sympathetic Affections of the Heart*, Jan., 1854.

belladonna ointment, with the effect of gradually relieving all the symptoms; and he left convalescent at the end of a month.

This case, and those succeeding, seem to prove that, in addition to complicating previous organic disease, the poison of lead may produce special morbid manifestations of its own, in a heart at first perfectly sound.

In the very great difficulty of retaining long enough for cure, out-patients among the necessitous and changing poor, the three following cases, which were treated for a few days only, on the same plan with those we have mentioned, are given merely to illustrate cardiac lead symptoms.

Case 4.—Lead Paralysis.—Feeble Heart.—Faintness on Exertion.—W. T., aged 39, shoemaker, of medium development, was admitted as an out-patient in the New York Dispensary, under our care, January 17, 1855, with partial paralysis of both forearms. He knew of no exposure to lead except drinking the Croton water conveyed by lead pipes in a high tenant house. Six months previous, at Staten Island, he had caught a quotidian intermittent, which was finally cured at Bellevue Hospital. Since then, for several months he had complained of muscular pains, trembling, and numbness of the limbs.

Condition.—We noted: lead streak of the gums; loss of motion, affecting the flexors as well as the extensors of the forearm, so as to prevent grasping; indigestion; constipation; pulse 64, weak; inability to mount stairs without faintness; cardiac oppression; palpitation, and a feeble tapping impulse of the heart.

Case 5.—Drop Wrists from Lead.—Tendency to Syncope.—Weak Cardiac Impulse.—M. S., aged 22, house painter, slight in figure, much emaciated and pale, was admitted under our care, at the New York Dispensary, August 25, 1853. He had suffered repeatedly with painters' colic during his apprenticeship. Three years since he had first felt numbness and loss of power in the forearms, for which he was treated with sulphur baths and galvanism for some time, with considerable improvement. Returning to the house-painting, he was finally quite disabled by more complete paralysis of both forearms and hands.

On examination, we found lead streak of the gums; tongue clean; appetite feeble; urine high-colored; some arthralgia, aggravated by damp weather; hands drooping and powerless; faintness on exertion; sinking palpitation; and weak impulse of the heart.

Case 6.—Debility of the Heart from Lead.—Gentle Tapping Impulse.—No Faintness on Exertion.—B. K., laborer, aged 32,

broad and muscular, having worked in a white lead factory from August to January, and suffered at length severe bronchitis from exposure was attacked immediately after with wandering pains and great muscular weakness, for which he was admitted at the New York Dispensary, March 15, 1854.

There were noted : distinct lead streak of the gums ; tongue slightly furred ; appetite feeble ; flatulence ; severe headache every afternoon ; pulse 60, compressible ; *weak velvety impulse of the heart*, but no special faintness on going up stairs.

In our fear of overstating this matter, we have rejected several slighter cases where there were simply a lead streak of the gums, without either paralysis or serious muscular debility ; but in which, with severe dyspeptic symptoms, constipation, and some prostration, there has been, as we have imagined, a slight shade of weakness in the impulse of the heart.

We may venture, too, in this connection to state a fact we have repeatedly verified in this series of observations, of much interest to the profession and public, in cities watered by lead pipes. Many cases in private practice, supposed to be ordinary dyspepsia, obstinate constipation, or bilious colic, are really *unsuspected mild examples of lead poisoning*. A highly intelligent professional friend suffered thus unconsciously for months, from drinking soda-water through lead pipes, in a warm summer, till, looking at his tongue one day, we discovered the lead streak of his gums. We remember prescribing for a "faint heart" in a "fair lady," with blue gums, who was "much debilitated," and who said she was engaged in a "store down town," which at last proved to be a type foundry. A pale young printer, at the New York Dispensary, incapacitated by indigestion and weakness for months, and, as he sorrowfully declared, "having spent all his money with the doctors,"—after showing "leaded" gums, and confessing also to spermorrhœa, wished a careful examination for the supposed "organic affection" of a *weak irritable heart*, occupying his entire sympathy.

In the following illustration, too, but for the suspicious gums, and avocation, it would have been easy to have overlooked the secret cause of suffering, in attention to the alleged "disease of the heart."

Case 7.—Cardiac Distress.—Prostration from Lead.—Night Faintings.—Recovery.—Mr. S., master house painter, aged 29, tall, muscular and temperate, having been under our care in private practice for an attack of incipient cholera during the late epidemic, and having suffered from debility and dyspepsia ever since, applied again a few

months since for an examination of his chest, insisting that "something was the matter with his heart."

Latterly he had grown very desponding, with a sense of utter weakness and cardiac oppression; faltering palpitation; variable appetite; belching flatulence; and turns of nausea, and severe headache. But the most alarming of all were certain paroxysms of fainting during sleep, detected by his watchful wife, which were more protracted and death-like than ordinary night-mare, and accompanied by ghastly paleness and coldness. They required mustard poultices and stimulants for several minutes to rouse him.

On examination, there were found slight lead streak of the gums; pulse 64; weak tapping impulse of the heart, else normal; no positive paralysis, but great muscular debility, producing a sense of constant weariness and prostration. Under the use of free doses of the iodide of potassium and minute proportions of nux vomica, as in the previous cases, after several returns of the fainting, he slowly recovered.

Early in these investigations we communicated our views of the effects of lead on the heart to our late worthy colleague, Dr. Elisha Harris, now Chief Physician to the Marine Hospital, Staten Island. He obligingly consented to consider the matter and furnish us the result. The testimony of so intelligent and careful an observer in the following two cases, kindly contributed by him, is specially valued by us as corroborating opinions on the depressing influence of lead on the heart, in which, in the natural enthusiasm of special study, we feared we might be too sanguine. In slowness of the pulse, cardiac oppression, great despondency, and tendency to fainting, the first case resembles that just recorded.

Case 8.—Prostration from Lead.—Heart Enfeebled.—Recovery.—Relapse.—Great Improvement.—We copy from Dr. H.'s manuscript notes:—Mr. C., house painter, æt. 48, a man of sound constitution and good habits, began to suffer from lead arthralgia about five years ago. Two years since he applied for medical advice, and he was then suffering from very severe pains in the joints, which prevented his rest at night, and partially disabled him from labor. He also suffered much from headache, and had periods of great prostration, during which, syncope usually occurred with more or less frequency.

The pulse was about fifty, exceedingly feeble; and the cardiac sounds were faint, while the heart's impulse was very feeble.

The characteristic mark of lead poisoning, the purple discoloration of the gums, was broadly developed, and the flexors of the upper extremities had become enfeebled, though not paralyzed.

Investigating by exclusion, no other cause than the lead poisoning could be found to account for the patient's enfeebled condition.
Treatment:

R. Potass. Iodid. gr. viij.
Tinct. Gentian comp. ʒij.
Tinct. Nucis Vomicae, gtt. vj.
M. To be taken four times a-day.

Under this treatment he rapidly improved, and after the first week, he rested perfectly at night, and suffered no more arthralgia. His heart regained its normal vigor and healthy impulse after about two months. He considered himself perfectly well at the time, and took no more medicine.

Continuing his employment as house-painter, his old difficulties returned during the last winter, and two weeks since he applied for advice again, when I found the heart nearly as feeble as at the time of my first examination, and I learned that he had for some time past suffered greatly from a sense of impending dissolution, which was most oppressive at night. His lead arthralgia had become more severe than ever previously. The heart beat more rapidly than before, and quite as feebly. He has been of the opinion that his life would suddenly terminate. His attacks of syncope have not been as frequent as formerly, but his sense of prostration was even more oppressive.

The treatment has been the same as previously. At the end of the first week he has been able to sleep soundly all night. His heart beats with a stronger impulse. He expresses himself as feeling a "new man."

Case 9.—Lead Paralysis.—Weak Heart.—Recovery.—M. M., aged 21, unmarried, of medium development, was kindly referred to me for examination, by Dr. H., Dec. 30, 1854. Three years since, she commenced working in a card manufactory in which she was obliged to use the carbonate of lead in the process of enameling or glazing. Eight months after, she was attacked with lead colic which lasted for four days, and she was finally relieved at the New York Dispensary, under the care of Dr. H., and by his advice she changed her employment. One year after, she returned to the card-making, at which she continued until four months later, when she was attacked with lead paralysis of the extensors of the right forearm or the "drop wrist," accompanied by general numbness; muscular wandering pains; lead streak of the gums; encrusted blackened teeth; loss of appetite;

palpitation; remarkably feeble impulse of the heart, and faintness under the least excitement or exertion.

Under the use of eight grains of the iodide of potassium in solution with a few drops of the tincture of nux vomica three times a-day;—with cessation from her employment—in the course of the next six months she almost entirely recovered; so that at the time of my examination, the paralysis was quite gone; the heart almost entirely recovered in its tone; and the patient felt relieved from the necessity of further treatment.

In the following case, still under the care of the writer, are several points of special interest. The paralysis of the muscles of both forearms was the most complete we have ever seen. Both the flexors and extensors were entirely powerless, so that the patient could not grasp or lift anything with the hands; but merely brought the arms together as if they had been amputated at the wrist. We shall not easily forget the imploring manner in which the patient, a stirring mother of six children, at her first visit held out her dangling, cold, palsied hands for relief. Yet the disease, for some obscure cause, was exceedingly local. Her face had nothing of the lead pallor, but was still blooming. The heart was the least affected of any in the cases related.

Case 10.—Lead Palsy.—Drop Wrists.—Dyspepsia.—Amenorrhœa.—Heart slightly enfeebled.—Recovering.—Mrs. J., boarding-house keeper, æt. 37, originally stout, and still retaining a ruddy English complexion, was admitted to the New York Dispensary under our care, Dec. 13th, 1855, with complete loss of motion in the muscles of both forearms.

Some time since, her husband had kept a porter-house, and then, and since, she had taken a glass of beer, drawn through lead pipes, two or three times a-week, when faint from over-exertion. Some of the customers were careful not to drink the first draught in the morning, but she was not very particular herself. Latterly, she had kept boarders in the upper part of a high house supplied with croton water through lead pipes. She had never before lost a day with sickness, except during her confinements with her children. Eight months previous the menses ceased, and two months after this event, she complained of pain and numbness in the ankles, with difficulty in walking. Four months ago, she began to be affected with loss of appetite, nausea, and occasional vomiting, which has continued ever since, and which has caused her the loss of thirty-five pounds in flesh. She never had lead colic. Five weeks previous to admission, palsy of her right hand and wrist

commenced, and one week later, the left hand yielded. She wept with despondency, and complained of being altogether in a deplorably helpless state, with the care of a large family, and unable even to feed herself.

Condition.—There were noted, hands drooping, powerless, and cold; slight lead streak of the gums of three lower teeth; pulse 96, feeble; no faintness on going moderately up stairs; heart's impulse slightly diminished, but not enough to be noticed except by special attention; nausea and vomiting; menses suppressed; troubled dreams and night-mare.

The case was so urgent that we determined to try all the usual remedies at once. She was ordered to take ten grains of the iodide of potassium in solution with five drops of the strong tincture of nuxvomica, for weeks, three times a-day; to use once a-week a full laxative of powdered sulphur, rhubarb, and ginger; and, every four or five days, to take, on going to bed, a warm sulphur bath for twenty minutes, in the proportion of one ounce of the sulphuret of potassium to six gallons of water, soaking the arms and hands much longer than the rest of the body; elastic bands composed of old suspenders were attached above the elbow, and to the drooping hands for part of the day, so as to rest the stretched, palsied muscles; the flesh-brush was freely used, and lastly, through the kind offices of my friend Dr. Strong, of Brooklyn, she had the intelligent and careful application of electricity every second day.

It was in fact a combined attack outside, inside, and every side, and in no infinitesimal doses. The prompt good effects were surprising. In a few days the stomach grew quiet, and the appetite returned in full force; shortly after, the menses reappeared; and later still the distressing coldness ceased, and strength began gradually to return to the palsied hands, so that she could take her food, and use them quite freely. At the time of finishing our report, six weeks from the commencement of treatment, under the continued use of all the remedies mentioned, she is evidently rapidly recovering.

For convenience of reference, we have prepared the following brief table of the above cases, exhibiting at a glance in parallel columns, the lead and heart symptoms, and some other points of interest. Numbers 1 and 2, marked by an asterisk in the first column, had previous organic disease of the heart from rheumatism, and were simply aggravated by lead. All the rest were free from any affection of the heart until the lead poisoning. Numbers 8, and 9, were those kindly furnished by Dr. Harris; while the remaining eight were under our own observation.

A Table shewing the Effects of Lead on the Heart in Ten Cases of Partial Paralysis or General Muscular Debility.

NO.	SEX.	AGE.	CONDITION, CAUSES.	OTHER LEAD SYMPTOMS.	HEART SYMPTOMS.	TREATMENT.	RESULTS.
1	M.	34	WAFER-MAKER.—From lead in coloring matters; after prostration from intermittent.	Waxy jaundice; purple gums; brown encrusted teeth; slight paralysis of limbs; great prostration, dyspepsia; constipation.	Signs of old rheumatic hypertrophy with mitral regurgitation and consequent enlarged liver; small weak pulse; feeble impulse; palpitation; faintness on exertion; fear of sudden death.	Taraxacum; bark; iodide of potassium; nux vomica.	Greatly improved.
2	M.	26	PEDDLER.—From drinking soda and Croton water from lead pipes; after some dis-sipation.	Lead colic; pale waxy skin; purple gums; brown encrusted teeth; general muscular debility; indigestion; nausea; constipation; severe headaches.	Signs of slight old rheumatic hypertrophy, with mitral regurgitation; faintness on exertion; cardiac distress; palpitation; morbid fear of death.	Purging with croton oil; anodynes; afterwards iodide of potassium and nux vomica.	Rapidly improving.
3	M.	34	LABORER.—From working in a white lead factory.	Violet streak of gums; incipient paralysis of limbs; nausea; tender epigastrium; indigestion; constipation.	Sinking palpitation; soft tapping pulse; dyspnoea; faintness on going up stairs.	Counter irritation; iodide of potassium; nux vomica; belladonna.	Left convalescent.
4	M.	39	SHOEMAKER.—From Croton water through long lead pipes after intermittent.	Partial paralysis of the muscles of the forearm; lead streak of the gums; indigestion; constipation.	Faintness on going up stairs; sinking palpitation; feeble impulse; pulse 64, weak.	Iodide of potassium and tonics temporarily.	Left hastily.
5	M.	22	HOUSE-PAINTER.—After repeated prostration by lead colic.	Complete paralysis of both forearms and hands; lead streak of gums; dyspepsia; arthralgia; much emaciation.	Faintness on exertion; weak impulse; sinking palpitation.	Sulphur baths and galvanism at first with relief. In the relapse iodide of potassium and nux vomica temporarily.	Discontinued attendance.
6	M.	32	LABORER.—From working in a white lead factory; after severe bronchitis.	General muscular weakness; lead streak of gums; dyspepsia; severe headaches; wandering pains.	Weak velvety impulse; pulse 60, and soft.	For a short time with the iodide of potassium and tonics.	Left early.
7	M.	29	HORSE-PAINTER.—After prostration by cholera.	Lead streak of the gums; general muscular weakness; nausea; dyspepsia.	Sinking palpitation; cardiac oppression; pulse 64, weak; alarming faintings at night; feeble impulse; fear of sudden death. Night-mare.	Iodide of potassium; nux vomica.	Recovered.
8	M.	48	HORSE-PAINTER.—Enfeebled by long and severe arthralgia.	Purple gums; muscular debility, especially of the forearms; lead arthralgia.	Alarming syncope; fear of sudden death; feeble sounds and impulse; pulse 50.	Iodide of potassium; nux vomica; gentian.	Recovered.
9	F.	21	Employed glazing cards, with white lead; lead colic.	Paralysis of right forearm; lead streak of gums; encrusted, blackened teeth; wandering pains; general numbness.	Feeble impulse; sinking palpitation; faintness on exertion.	Iodide of potassium; nux vomica.	Recovered.
10	F.	37	BOARDING-HOUSE-KEEPER.—From beer and Croton water through lead pipes.	Paralysis of both forearms and hands; lead streak of the gums; vomiting; dyspepsia; arthralgia. Lost 35 lbs.	Slightly enfeebled impulse; weak pulse; great despondency. Night-mare.	Sulphur baths and laxatives; iodide of potassium; nux vomica; electricity.	Rapidly recovering.

Very briefly, we may, in conclusion, notice a few of the points suggested, under appropriate heads.

Symptoms.—Commencing with the most frequent, and their intimate companions, we may rapidly enumerate, italicising the most important. In the ten cases, *violet or purple streak of the gums*, the most constant and delicate test of lead contamination, either in disease or apparent health—was found in all; its occasional associate, blackened, encrusted teeth, three times; *dyspepsia*, nine; its frequent concomitants, nausea and constipation, each three; *partial paralysis*, seven; and general muscular debility, three; * *pains* in the joints, muscles, or head, seven; emaciation moderate, and not of the skinny cadaverous kind sometimes seen, twice; and lastly, lead jaundice of the regular dirty, tawny hue, and characteristic of the free absorption of lead by the lungs or stomach, once.

The Heart symptoms, as subjects of our special study, invite more attention.

The *weakened impulse* of the heart, characteristic as we have stated of either lead paralysis, or debility, was present more or less, nine times out of the ten. Just as with nice shades of difference in the pulse, or sounds of the heart, it requires a little close attention and education of our senses to discriminate. A superficial or inexperienced observer might fail in its detection. We must seize a tranquil moment in the right position. The sight, hearing, and touch, must be delicately exercised. Variations in the visible movement, in rapidity, volume, sound, and strength, between morbidly slow or rapid *feeble tapping*, and the healthy *firm striking* of the heart must be carefully appreciated. Where lead colic prevails uncomplicated, with either paralysis or marked debility, the stimulus of pain seems generally to cause a *firm hard impulse*.

Faintness on Exertion, requires usually pointed questioning. The patient commonly complains of so many bad feelings, that he forgets this, unless made the object of his attention. We generally ask the easily understood question, if there is unusual faintness or op-

* The following numbers represent the relative frequency of lead paralysis in different parts of the body, in a table of 102 cases, furnished by Tanquerel: general paralysis of upper extremities, 5; paralysis of shoulder, 7; do. of the arm, 1; arm, forearm, wrist, and fingers, 4; forearm, wrist, and fingers 14; wrist and fingers, 26; wrist, 10; fingers, 30; vocal muscles, (aphonia, 16; stammering, 15;) 31; intercostals, 2; dorsal, pectoral and sterno-mastoid, 1; general paralysis of lower extremities, 1; paralysis of thigh, 5; of thigh, leg, feet, and toes, 2; foot and toes, 3; foot, 2; toes, 2.

pression on going up stairs. It was recorded in seven of the above ten cases.

Syncope or *actual fainting* found in two of our cases, has been aptly termed by Bouillaud, "momentary paralysis" of the heart.* From the frequency of sudden death in organic cardiac affections, the occurrence of a protracted fainting fit with distress at the heart, naturally excites much alarm. In one case above, it occurred during sleep.

Palpitation so far as the patient is concerned, may be defined to be a painful sense of the action of the heart. And this may be from excited sensibility, mechanical enlargement, overaction, or even want of action. When the heart is depressed, or, so to speak, slightly paralyzed by lead, the sensation of faltering or fluttering naturally excites the attention of the sufferer, and if intelligent, he may possibly describe his feelings by the term "sinking palpitation." It was noted eight times out of ten. Cardiac oppression and slight dyspnœa, are generally associated with palpitation, though often not specially mentioned.

Night-Mare and Troubled Dreams, depending probably on the same causes during sleep, occurred twice.

Great Despondency and Fear of Sudden Death, noticed in three of the above cases, are natural characteristics of the more oppressive forms of heart disease. Contrasted with the buoyant hope of consumptives, the depression of cardiac affections is peculiar. When long existing, the sufferers are apt to become prematurely careworn, or gray.

The Pulse, as Tanquerel has observed, in lead paralysis, is almost uniformly soft, compressible, and slow. It usually ranges from 50 to 65, showing that the heart which propels it is feeble. In five instances above, the pulse is mentioned as "weak." On the contrary, the stimulus, of pain, generally renders the pulse in simple lead colic, like the heart's impulse, both hard and full.

Causes.—This term is of course used in a liberal sense, referring to any accessory circumstances or agencies. Anything that prostrates the system, seems to act as a predisposing cause. An intelligent superintendent of white-lead works in Brooklyn, informed the writer, that a few days of hard drinking with any of the workmen, were sure to be followed by colic or paralysis. It is doubtless thus, that successive shocks of lead colic are often finally succeeded by palsy. In two of the cases given, there was just previously intermittent fever; in

* *Maladies du Cœur.*

one each bronchitis, cholera, protracted lead colic, arthralgia, or intemperance.

As conditions acting as exciting causes, in our list seven were workers in some form of lead, and three were affected from drinking Croton water, beer, or soda-water, through lead pipes.

We have before alluded, in passing, to many known or unsuspected methods of exposure to lead. In illustration, we may simply add the following list from the great work of Tanquerel des Planches: * "Of 101 subjects of lead paralysis, there were manufacturers of white lead, 31; do. of minium, 6; painters of buildings, 22; do. of carriages, 4; do. ornamental, 5; grinders of colors, 6; manufacturers of German cards, 1; potters, 5; refiners, 3; plumbers, 3; type founders, 4; printers, 3; lapidaries, 3; cutters of crystals, 1; manufacturers of acetate of lead, 2; do. sulphate of lead, 1; do. chromate of lead, 1."

Pathology.—Disease is commonly but the process of dying, arrested in recovery or consummated in death. In the celebrated treatise of Bichat, there are three modes of dissolution enumerated; death by the brain, lungs, or heart; or, by coma, asphixia, or asthenia.† Lead may reach the heart through various channels. Some have supposed lead colic to be simply neuralgia of the great sympathetic nerves. If so, why may not the opposite or anasthetic condition prevail in paralysis, affecting both nutrition and the circulation by producing both constipation and indigestion as well as weakening of the heart? We may, indeed, account for the heart symptoms in two ways: either by supposing it involved in the general torpor of the ganglionic or spinal system; or, as Christison believes, by assuming that lead has a specific effect on the heart itself, tending to death by asthenia. Facts respecting other poisons, and even lead itself, strongly favor the latter theory.

Sir Benjamin Brodie, in some experiments upon animals, related in the Philosophical Transactions, states that on injecting into the body either the oil of tobacco or the upas antiar, there were great faintness and sinking of the pulse, and on examination immediately after death, he found the heart distended with florid blood, paralyzed, and insensible to galvanism though the rest of the muscular system could be stimulated by it to contraction. The woorara poison of the South American Indians is said to produce like effects. Though primarily acting as an irritant to the alimentary canal, arsenic is also classed by authorities, among the agents that kill by paralyzing the heart. A friend of ours in Brooklyn, fond of researches in natural science, happened,

* *Maladies de Plomb.*

† *Sur la Vie et sur la Mort.*

under the orders of his physician, to be taking Fowler's Arsenical Solution. At length he felt his heart beating very faintly, and became greatly prostrated. On repeatedly examining his own pulse, he found it soft and weak, and he could only make fifty beats in a minute. These are just the symptoms we have ascribed to lead in paralysis. We know, too, by daily practice, that digitalis acts mainly on the heart and circulation.

We are not left, however, to mere conjecture from analogy. In experiments detailed in the *Edinburgh Medical and Surgical Journal*, Mr. Blake found that a dram of the acetate of lead taken into the stomach of a dog, suddenly arrested the heart's action, and that the small quantity of three grains injected into the jugular vein, diminished the force of the heart.

Foidèrè,* in the post-mortem examination of a patient with lead disease, describes the heart as presenting a shrunken or "withered" appearance.

Again, setting aside the dispute about "natural lead," the chemical researches of Orfila, Tiedeman, Gmelin, Devergie, and Guibort, have detected in subjects who have died of lead disease, an unusual amount of the poisonous metal in the brain muscles, thoracic and abdominal viscera, and especially in the blood.

Now, as every-day practice proves, even when medicinally applied to the skin, lead is a sedative. Let its poison course along the lining membrane of the arteries and veins, and thus mingling with the blood, its vital stimulant, bathe constantly the central organ of circulation, and we can easily see why the heart should especially feel its paralyzing influence.

Treatment.—The chief remedies to counteract the depressing effects of lead may be divided into two classes. The first may be termed *disinfectants*, such as the iodide of potassium, and the various preparations of sulphur; and these act by eliminating the poison from the system, and thus remove causes.

The second class—if we may coin a word easily understood—may be designated *Anti-paralytics*, such as strychnia and electricity. These restore tone to the injured organs, and thus powerfully relieve effects.

Iodide of Potassium.—The "disinfectant" properties of this powerful antidote to the slow poison of lead and mercury have been mainly brought to light through the recent researches of M. Melsens of Paris.

* *Médecine Légale.*

In an article inserted in this Journal some time since, we had occasion to publish some illustrative cases with a brief review of the original memoir of this indefatigable observer.* M. Melsens, by well-recognized facts, established two propositions: first, that *lead and mercury combine with the tissues of the body, and remain there for years*; and second, that *the Iodide of Potassium acts as a powerful solvent to the compounds of both lead and mercury thus fixed in the system, disengaging them and draining them off, so to speak, by the urine through the kidneys*. And he proved these principles by an array of chemical and clinical experiments. He took a large quantity of the iodide of potassium himself, and discovered it quickly and almost exclusively in his urine; he gave it to a patient with mercurial palsy, and, on analyzing the urine, found the iodide of mercury; he paralyzed and emaciated several dogs till nearly dead, by feeding them with the sulphate or carbonate of lead, and then restored them rapidly to health and flesh with the iodide of potassium; and finally he cured or greatly relieved, with the same remedy, three patients paralyzed by lead, and five by mercury. Experiments by others have since detected the iodide of lead in the urine of patients under this treatment for lead paralysis. Though M. Melsens gave the iodide of potassium without inconvenience in large doses for weeks and months, commencing with half a dram and running up to a dram and a-half daily,—yet with this somewhat expensive article among the poor, we have succeeded very well in the more moderate dose of ten grains three times a-day for a few weeks or months. It is more cleanly and convenient, and less expensive, than sulphur baths. And if reduced to a single remedy we believe none so efficacious.

Sulphur Baths.—Sulphur in every form is an antidote to lead. Sulphuric acid internally, the sulphates of magnesia and soda as purgatives, and sulphur as a laxative, have all been used. Natural sulphur springs have long been resorted to for bathing purposes, with great benefit in lead affections. Our own of Virginia are excellent. Fortunately for the laboring classes, we have an admirable substitute highly recommended by the Tanquerel, Dr. Alderson, and the best authorities. From four to six ounces of the sulphuret of potassium—an ordinary cheap article of commerce—may be dissolved in sufficient tepid water to make a comfortable bath for an adult. The patient may remain in this from twenty minutes to an hour, not using it so frequently as to produce too much debility, and sustaining the muscular strength in the

* Cases testing the Iodide of Potassium as an Antidote, etc., September, 1853.

meantime by strychnia, electricity or other agents. In many cases a brown coating of the sulphuret of lead is formed on the skin, so that the poisonous metal is literally *soaked* out of the system. These baths in moderation are generally very grateful to the patient.

Antiparalytics.—In emergency we have adopted this term, to designate a subdivision of the class of tonics, noted for their special power in relieving paralysis; just as in medical language we have already accepted the terms antispasmodics or antiperiodics from their power in arresting certain other symptoms of disease.

Nux Vomica or Strychnia.—The antiparalytic power of the vomica nut and its active principle strychnia, is too generally recognized to need much comment. Both, in large doses, are known to be powerful poisons, and both, in minute safe proportions, are valuable tonics. Linnæus long ago suggested nux vomica in dyspepsia. Alone or combined with small quantities of rhubarb or aloes, the extract or tincture of nux vomica, are valuable remedies in constipation. Both these symptoms prevail in lead disease. While the extract and tincture have appeared to us most useful in indigestion and constipation, the alkaloid strychnia is the most uniform in strength, and most reliable in the restoration of parts paralyzed. Yet all the preparations of nux vomica possess this power. On the moderate exhibition of strychnia, as we know, prickings and spasmodic twitchings, or slight convulsive movements of the limbs, occur, producing a faint imitation of the tetanus which some have termed *strychnism*.

These stimulating and vivifying effects seem at length to centre on the weak, or paralyzed muscles, and often happily end in cure.

Strychnia, it will be recollected, should be commenced cautiously, in doses of about one-twentieth of a grain in pill, or, what is more convenient, in solution of a grain to the ounce, of one part acetic acid, and three of water; and gradually increased to a quarter, or even half a grain three times a-day. Tanquerel, commenced with the sixth and ran up to even two grains, in the twenty-four hours, and with great success. Where preceded or combined with *disinfectant* treatment, we have never found more than half the first-mentioned proportions necessary. Sometimes it has been applied externally as an ointment, or to a blistered surface. In dispensary practice among a class of patients, where mistakes are more likely to occur, we have invariably preferred the milder and safer, though perhaps slower, tincture of nux vomica. Weber, found that on touching the heart of a dead frog with a solution of strychnia, he produced rigid *tonic contraction*. We

have long preferred it as a tonic to any other remedy in most forms of debility of the heart, and especially in that from lead.

Electricity or Galvanism has been used with more or less success as a remedy for paralysis for a century. Tanquerel, cured eight patients with lead palsy, who persevered with it, out of fifteen. Dr. Golding Bird, as stated in his valuable paper, in the *Guy's Hospital Reports*, was also very successful with this agent in paralytic cases. It is particularly suited to those that are slight and limited.

A gently stimulating current, not too violent, is commonly passed from the point of origin, to the termination of the particular nerves affected.

We may further remark, that we think no plan of treatment perfect, that does not combine, either together or in succession, both a disinfectant and an antiparalytic agent. The most convenient and efficacious we believe to be the iodide of potassium, and nux vomica, or strychnia. To these may be added good food, fresh air, and the flesh-brush. Sulphur baths and electricity are excellent auxiliaries if needed. To prevent a relapse, and, in fact, to prevent the disease altogether, nothing is so efficacious as that which a good house-wife once ranked next to the highest Christian virtue—*perfect cleanliness*. Free ventilation, frequent washing of the hands, face, and mouth, cleansing even the nails; wearing a compact linen suit washed twice a week, and changed on leaving work; a light cap to protect the hair; and an early laxative in slight constipation,—have protected the most exposed from an hour's suffering in many years.

In closing we may remark, that although some authors have, in passing, alluded to palpitation and slow pulse, as present in isolated cases of lead paralysis, yet, in yielding to the evidence of our senses, and believing feeble impulse of the heart, and faintness on exertion, to be prevailing characteristics, we are forced beyond the beaten track. We urge not our opinions on others, but only ask fair consideration of our cases. One well-established fact is worth a thousand visionary hypotheses. The vast domains of medicine are filled with the ruins of magnificent temples reared by master minds, of which time has swept away beautiful columns and arches of theories, while their facts, as solid foundations, forever remain.

The evidence gathered in this discussion tends, as we believe, more or less, to establish the following

CONCLUSIONS.

- 1.—That allowing a due excess of force to carry on the embarrassed

circulation in organic affections of the heart, it appears that certain symptoms in slow poisoning from lead, as well as in cardiac disease proper, typhus fever, and apparent death from catalepsy or other causes, all tend to prove that, as a rule, the *impulse* may be termed the *pulse of the heart*; and that, its more careful study than heretofore, may aid us in the general diagnosis and treatment of disease.

2.—That the symptoms of weakening of the heart in lead poisoning, are confined to cases of *partial paralysis, or general muscular debility*, accompanied usually by the purple streak of the gums, indigestion, constipation, pains in the head, muscles, or joints, and sometimes by lead jaundice; and that commencing and emphasizing with the most frequent, these heart symptoms from lead are:—*weakened or soft tapping impulse; faintness on unusual exertion; feeble and generally slow pulse; palpitation; cardiac uneasiness; and to these are occasionally added, great despondency or morbid fear of death; suspicions of organic disease of the heart, fainting fits, night-mare, or troubled dreams.*

3.—That these depressing heart symptoms are absent in the earlier and more acute stage of lead poisoning, known as "*lead colic*," when, on the contrary, the stimulus of pain generally renders the impulse of the heart and the pulse at the wrist more firm than natural.

4.—That skill in the detection of minute variations in the impulse of the heart, naturally requires a little careful attention and practice.

5.—That these debilitating effects of lead most commonly occur in hearts previously sound, but they sometimes complicate existing organic cardiac disease from rheumatism or other causes.

6.—That the agencies or causes of lead poisoning are very numerous, and often obscure; and that slighter cases supposed to be ordinary dyspepsia, constipation, debility, or bilious colic, are frequently undetected.

7.—That the above tests of the immediate influence of lead on the heart in disease, are further corroborated by experiments upon animals; showing that, more mildly and slowly, *lead*, like digitalis, oil of tobacco, upas antiar, the woorara, and some other poisons, tends specially to paralyze the central organ of the circulation, and, like these, ultimately to produce what Bichat termed "*Death by the heart.*"

8.—That the remedies for the paralyzing influence of lead may be divided into two classes:—*Disinfectants*, such as the iodide of potassium, and preparations of sulphur; and *Antiparalytics*, such as strychnia and electricity; that the best treatment combines these two elements; and that, on the whole, the most convenient and efficacious

are free doses of the iodide of potassium, and minute proportions of strychnia or nux vomica.

9.—That the above conclusions are founded mainly on the evidence of ten cases, principally among the badly-nourished and improvident poor finally resorting to public institutions; and they may possibly be somewhat modified in future by more extended observation in private and more favorable practice.

